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AGRICULTURAL NEWS LETTER

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This publication contains information regarding new developments of interest to agriculture based on laboratory and field investigations of the du Pont Company and its subsidiary companies. It also contains published reports and direct contributions of investigators of agricultural experiment stations and other institutions as related to the Company's products and other subjects of agricultural interest.

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WHAT'S IN A NAME? PLENTY OF CHEMISTRY!

A new chemical product, unlike a new baby, is usually given a "coined" name -- one never heard of before.

Recent announcements by Du Pont, for instance, tell of many new agricultural materials with a variety of interesting, but previously unfamiliar, trade names. Dozens -- often hundreds -- of suggestions are considered, evaluated, and discarded until one is finally adopted and registered.

Many Product Names Derived from Greek and Latin

Du Pont name-picking experts, with the assistance of volunteer amateurs, sometimes go back to the Greek and Latin for ideas.

For instance, a couple of new fungicides were given trade names ending with the Latin "san," derived from sanare -- to cure, to heal, to give health. It is the distinctive ending used for an established series of seed disinfectants and protectants which include such products as "Semesan" fungicide and "Ceresan" fungicide, the latter also utilizing the name "Ceres," Roman goddess of grain. "Thiosan" fungicide, used in spray form for brown-patch and dollar-spot control in turfs, contains tetramethyl thiuram disulfide, an organic sulfur compound. "Thio," if you recall your Greek, means sulfur. "Thiosan" is not available at the moment because of war emergencies, but will be marketed again as soon as conditions permit.

The other new seed-treating product, "Arasan" fungicide, also contains tetramethyl thiuram disulfide, but, since this material was originally compounded as a disinfectant and protectant for dusting peanut seed, the first three letters were taken from Arachis hypogaea, the botanical name for the peanut. More recently, "Arasan" has been found highly effective in the control of decay and certain seed-borne and soil-borne diseases of many vegetables, seed corn, and other important farm crops.

Some Combine First and Last Syllables of Chemical Names

Some names are made by combining the first and last syllables of the long words used to denote the chemical compound which constitutes the active ingredient. "Fermate" fungicide, for instance, is largely ferric dimethyl dithiocarbamate. Join the first and last syllables and you have "Fermate." "Ammate" weed killer is primarily ammonium sulfamate. Combine the first and last syllable, and you have the name.

There are many other ways by which names are created. There's "Parmone" pre-harvest fruit-drop spray, used to inhibit pre-harvest drop of apples and

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pears. It contains naphthalene acetic acid, a plant-hormone substance. "Hormone" changed to "Parmone" -- sounds logical, doesn't it?

Vitamin D_3 is obtained by irradiating a sterol, 7-dehydrocholesterol. Note the last two syllables -- "sterol." Write down the Greek "Delta" for D, add "sterol", and you have "Deltasterol." Shorten this to "Delsterol" and you will know where the name "Delsterol" D-activated animal sterol, which supplies vitamin D for poultry feeds, came from.

"Delsterol" is obtained by changing chemical substances known as animal sterols into vitamin D by irradiation with ultra-violet light. It is very effective in preventing or curing rickets in baby chicks, in promoting sound growth, normal health, satisfactory egg yield, good shell texture, and good hatchability. Additionally, it is scientifically controlled, and does not impart "off" tastes or odors.

How "Uramon" and "Two-Sixty-Two" Got Their Names

A somewhat older name is "Uramon" fertilizer compound. This material contains 42 per cent nitrogen in the form of urea, a member of the ammonia family. Combine "urea" and "ammonia;" take a few liberties with complicating syllables, and a euphonious, descriptive name results.

Sometimes numbers are used -- for good reason. Du Pont's new material containing urea, designed especially to supply some of the protein in mixed feeds for cattle, sheep, and other ruminants, has been given the name "Two-Sixty-Two" feed compound. It happens that this new material has nitrogen equivalent to 262 per cent of crude protein. Hence, the name.

And so on into the hundreds and even thousands of new names for chemical products, not only for agriculture, but for numerous other purposes -- names "made to order" by these and other word-building procedures.

NOTE: Leaflets and booklets giving detailed information regarding the various agricultural chemicals mentioned in the foregoing article are available upon request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Delaware. Please indicate product in which you have special interest.

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Vol. 13 No. 1 January-February, 1945

DESTRUCTION OF WEEDS OFTEN HELPS SAVE CROPS FROM INSECTS AND DISEASE

Kill the weeds around the farm and orchard to help save cash crops from destruction by insects and plant disease!

This may well become a new agricultural maxim, especially in areas where wild plants act as cover, as alternate hosts, or as harborers of insects and plant-disease organisms that compete with man for his means of subsistence.

Chemistry Offers New Means of Controlling Noxious Weeds

In this war against these noxious weeds, chemistry offers a new weapon that opens an entirely new approach to environmental pest control in and around orchards and fields. This new material, "Ammate" weed killer, the active ingredient of which is ammonium sulfamate, has been found to be exceptionally efficient in the destruction of numerous undesirable weeds and plants.

For instance, it has been used to destroy the chokecherry, an uncultivated bush that acts as a bridge to carry the yellow-red virosis or "X" disease from one peach orchard to another. It has also been used successfully in recent experiments at the New Hampshire Agricultural Experiment Station to kill the common barberry, the alternate or overwintering host of black stem rust, fungous disease of wheat.

Du Pont Entomologist Discusses Environmental Control of Pests

Dr. Harry F. Dietz, Entomologist of the Du Pont Pest Control Research Laboratory at Wilmington, Dela., says that while spraying and dusting with insecticides and fungicides are essential in any complete pest-control program, destruction of noxious weeds is often an important supplemental procedure. This makes growing conditions less favorable for at least some insects and disease organisms.

"Weeds, especially those belonging to the aster family, and even alfalfa, if allowed to seed, favor the building up of heavy populations of certain plant bugs that may attack fruits like peaches," according to Dr. Dietz. "The plum curculio hibernates in weeded fence rows which can be readily eliminated, and in woodlands which cannot be sacrificed for control of the overwintering curculio. But the orchardist can do a better job of spraying of those parts of the orchard nearest to woodlands where curculio first congregate and feed in the spring before dispersing throughout the rest of the orchard, and he can destroy the weeds that offer cover to the pest during the winter."

Dr. Dietz says orchardists are also confronted with the control of poison ivy and poison oak in the orchard to protect workers from the miseries of ivy poisoning. The most effective weed-killing chemicals in the past, he said, have been soluble arsenical sprays and sodium chlorate.

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"However, orchardists are fully aware of the danger of soluble arsenicals in poisoning the soil around trees, and the fire hazard which sodium chlorate presents," he says. "If there is anything an orchardist fears more than insects and fungous diseases in his orchard, it is fire."

The Du Pont entomologist points out that a promising solution of this problem had been found in ammonium sulfamate, which may be used with relative safety to humans and animals.

"It is actually a good flame-proofing agent," he adds. "Ammonium sulfamate, the herbicide and industrial chemical, should not be confused with ammonium sulfate, the fertilizer. Such confusion could lead to disastrous results."

Suggestions for Use of "Ammate" Weed Killer in Orchards

"When used for the control of poison ivy and other weeds in the orchard, ammonium sulfamate has not shown a tendency to poison the soil," he explains, adding that application to the foliage of fruit trees, nevertheless, must be avoided, and that orchardists must use this material with judgment.

"The fact that it kills chokecherry so easily and that chokecherry is related to our stone fruits means," he says, "that it should be used with the utmost care in peach, cherry, and plum orchards, although its use in apple orchards has shown no adverse effect so far, even where the material has been applied to ivy climbing on the trunks of trees ten or more years old. It might injure young apple and pear trees if applied to the tender bark."

Environmental Conditions and Cultural Practices Are Important

Dr. Dietz mentions other environmental conditions and cultural practices that seriously affect the whole problem of insect and disease control. For example, he says the old system of clean cultivation in vogue several decades ago is unquestionably favorable for codling moth, since it permits high orchard temperatures and greater heat reflection into the trees than does a sod cover with its cooling effect due to transpiration.

"On the other hand," he adds, "the sod cover is not an unmitigated blessing, in that it may favor the multiplication of the destructive apple flea-weevil and favors the development of apple scab. In fact, the original sod orchard in Ohio was seriously damaged by flea-weevil before a highly effective chemical control for it was found in fluorine insecticides. Likewise, the sod cover seems to have favored the development beneath the trees of weeds such as poison ivy, poison oak, certain wild grapes, matrimony vine, and deadly nightshade. In the Central and Southern Atlantic States, the sod cover or mulch has favored the growth of the Japanese honeysuckle. Thus this practice has created the need for weed control, another important problem."

The Du Pont research scientist adds that where cover crops, such as alfalfa or weeds, are allowed to grow rampant in young orchards, buffalo tree hopper, usually considered a very minor pest, may seriously scar and weaken the

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branches of the trees with their egg-laying punctures. In areas where grasshopper outbreaks occur, alfalfa may provide sufficient food to keep these pests from doing serious damage to the trees; but, as Dr. Dietz expresses it, "woe betide the orchardist who cuts the crop for hay and forces the hoppers into the trees."

Other Procedures Recommended for Pest Control

"The presently favored straw mulch furnishes an ideal winter harbor for several kinds of mice which may girdle the trees," he said. "Hence, it must be removed from contact with the trunks of the trees and suitable measures taken to control the rodents. Apple and quince rust may be controlled by removing all red cedars within a mile of the orchard. These rusts cannot survive in the absence of either one of their alternate hosts. In some localities where red cedar grows abundantly, it is often so highly valued as a timber tree that orchardists themselves will not remove the trees on their own premises. Under such circumstances, other methods of control must be sought."

A new material, "Fermate" fungicide,* has given good results in the control of cedar rust and other apple diseases, including scab, Brook's spot, apple blotch, and defoliation due to black rot.

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*A bibliography, listing 110 publications on "Fermate" fungicide, from September 11, 1934 to July 1, 1944, prepared by Dr. Harry F. Dietz, Entomologist, Du Pont Pest Control Research Laboratory, will be sent upon request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Del.

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MOTION PICTURE "SOLDIERS OF THE SOIL" WIDELY USED - PRINTS STILL AVAILABLE

Du Pont's motion picture "Soldiers of the Soil" has been shown during the past year to nearly 13,000 audiences totaling approximately 1,500,000 persons -- mostly rural. Bookings for 1945 continue heavy.

The picture tells the story of a farm boy who must choose between the excitement and glory of war and the prosaic farm job which provides the sinews of war, but without uniforms or medals. It shows how a returned soldier brother, whose fighting days are ended by blindness, helps him decide.

Prints are still available in either 16 or 35 mm. size, through the usual state agricultural film libraries, including the offices of the State Agricultural Extension Services and the State Directors of Vocational Agriculture. The film can also be obtained by writing the Editor, Du Pont "Agricultural News Letter", Wilmington 98, Del.

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EMACIATION IS COMMON SYMPTON OF PARASITISM IN CATTLE

"Primary parasitic gastritis in cattle occurs in California in calves and steers being fattened on the lush, irrigated Ladino-clover pastures of the interior valleys. Calves are most susceptible, although yearling and two-year-old steers will break down with primary parasitic gastritis if overcrowded on these pastures long enough.

"The onset and course are gradual and the cattle present typical symptoms of parasitism such as anemia, diarrhea, submaxillary edema, rough coat, and emaciation. The more common form of parasitism is seen as a complication of malnutrition in the early fall in range cattle. As a rule only the yearlings are affected and in contrast to primary parasitism, the onset and course are rapid. In some cases the cattle die within two weeks after showing rapid emaciation and terminal diarrhea. The rapid course has often led to an erroneous diagnosis of hemorrhagic septicemia.

"Usually it will be found that the ranges have dried up except for small areas of green feed around water holes, springs, and creek beds. The cattle tend to gather around these places for four to five hours daily and undoubtedly acquire massive infections rapidly which, in connection with the inadequate feed on the ranges, produces the clinical picture of extreme parasitism described. As the winter rains bring on the green feed on the ranges, improvement becomes apparent and many recover spontaneously.

"When older cattle are likewise affected, infections with the liver fluke, Fasciola hepatica, are almost invariably present in addition to stomach worms.

"Finally, parasitic gastritis is observed in the north coast counties as an important factor in a disease complex which affects dairy calves principally. In this complex, lungworm, malnutrition, lice, calf pneumonia and parasitic gastroenteritis are frequently found co-existant and it is usually impossible to determine the primary etiological factor. In all forms of parasitic gastroenteritis found in California, Ostertagia ostertagi and Trichostrongylus axei are the principal parasites involved."--Dr. J. W. Britton, Agricultural Experiment Station, Davis, California.

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PHENOTHIAZINE WIDELY USED FOR CONTROL OF INTERNAL PARASITES IN CATTLE

Phenothiazine therapy for control of stomach worms and certain other internal parasites that cause parasitic gastritis has achieved wide use for cattle, with much of the information regarding the efficacy of this drug simply borrowed from sheep work.

So says Dr. J. W. Britton of the Division of Veterinary Science, University of California Agricultural Experiment Station at Davis, California. Writing in "Veterinary Medicine," Vol. 39, No. 6, Dr. Britton says that the reasons for widespread popularity of phenothiazine "are to be found in the relative ineffectiveness of other drugs commonly employed, and in the difficulties inherent in treating cattle individually."

California Veterinarian Reviews Literature and Makes Recommendations

In reviewing the available literature and reporting on the use of phenothiazine in cattle under California conditions, Dr. Britton concludes that: "For clinical recovery doses of 12 to 15 grams of phenothiazine for calves, and 20 to 30 grams for yearlings are sufficient. In these dosages phenothiazine is non-toxic for cattle."

He explains that fortunately cattle are nearly as tolerant as sheep to any toxic effects which phenothiazine may possess. However, he reviews several instances where overdoses produced harmful results, one dose of 85 grams apparently causing the death of a 105-pound calf.

"It will be noted that these cases in all of which toxic effects occurred, followed doses from three to six times as large as those found to be satisfactory under California conditions."

Convenient Method of Determining Proper Dosages

"A convenient method of determining dosage is to tightly fill a half-ounce capsule for calves, an ounce capsule for cattle 12 to 16 months of age, and an ounce-and-a-half capsule for older cattle. These capsules hold 12, 25, and 40 grams respectively," he explains.

Phenothiazine Greatly Superior to Cunic Mixture

Dr. Britton says that in the trials with phenothiazine which he reports, "the superiority of phenothiazine over cunic mixture* in the control of bovine parasitic gastritis adequately confirms the previous work of Stewar and Crofton, and Porter, et al. The former demonstrated that in winter trichostrongylosis

*A mixture of copper sulfate and nicotine sulfate.

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of yearling cattle, a condition similar to range parasitism in California, phenothiazine produced an average gain of 21 pounds in six months against an average loss of 16 pounds in cattle receiving cunic and an average loss of 71 pounds in untreated controls. These were similar cattle kept on maintenance rations.

"Porter et al. also found phenothiazine to be more effective than cunic, and in addition reported that phenothiazine increased the packed red blood cell volume an average of 2.3 per cent, whereas similar cattle treated with cunic showed a reduced cell volume of 1.8 per cent, and untreated controls showed a reduced cell volume of 1.1 per cent. In their hands as in the California outbreaks**, cunic failed miserably in heavy infections."

**Reported in Dr. Britton's paper.

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FORMALDEHYDE ENHANCES DISINFECTING VALUE OF WHITEWASH

While ordinary whitewashing of farm structures helps keep them attractive and clean, addition of a small amount of formaldehyde to the whitewash solution arrests decay, kills disease germs, controls offensive odors and molds, and generally promotes sanitation, thereby safeguarding the health of human beings and livestock. Formaldehyde alone, in dilute form, is an effective disinfectant, fungicide, germicide, and deodorant, both inside and outside the home.

Where formaldehyde is normally scrubbed or sprayed on stables, pig pens, chicken coops, poultry runs, pigeon lofts, dog kennels, and other outhouses, and where these structures are frequently whitewashed, one operation can be eliminated by adding the formaldehyde to the whitewash solution. Du Pont formaldehyde authorities advise that a 14-quart pail of whitewash can be formulated as follows: 7 pounds slacked lime, 6 ounces glue, 6 ounces formaldehyde, and 2½ gallons of water.

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MOLASSES AS CARBOHYDRATE IN RATION CONTAINING UREA

For the most efficient utilization of urea by ruminants, some slowly hydrolyzable carbohydrate, such as starch, should be provided in the ration. Where practically all of the readily fermentable carbohydrate is supplied by a soluble sugar somewhat less satisfactory results are secured. This information was developed at the University of Wisconsin by R. C. Mills, C. C. Lardonois, I. W. Rupel and E. B. Hart, and was reported in the "Journal of Dairy Science," Vol. 27 No. 7.

Heifer With a Rumen Fistula Used

A 1000-pound Holstein heifer with a rumen fistula equipped with a removable rubber plug to facilitate sampling was used in the first experiment. The animal was fed the experimental ration at 8 a.m. and 6 p.m., and samples were taken from the rumen 1, 3, and 6 hours after the morning feeding on Mondays and Fridays over a period sufficiently long to give constant results for several days. Then the ration was changed, and a period of three weeks allowed for adjustment before studies on the rumen contents were undertaken again. Nine experimental feeding periods were involved. After the first period when the animal received 12 pounds of timothy hay alone, the animal was fed 10 pounds of timothy hay daily. In addition to the hay, various combinations of urea, molasses, starch, and casein were supplied.

Results Obtained In First Experiment

Analyses of samples taken from the rumen showed a slower disappearance of ammonia, and therefore a slower utilization of the urea nitrogen, where urea was used in connection with molasses than where used with starch. The use of molasses and urea increased the protein level of the rumen contents, but a higher protein level was obtained when starch was substituted for one-half of the molasses. Addition of casein to the hay, starch, and molasses raised the protein level, as would be expected. The further addition of urea to this casein-containing ration caused the protein level to rise to 11 per cent of the total dry matter, but the protein did not rise above this level, although ammonia was available for conversion into protein.

Feeding Trials With Three Calves

Since the first experiment showed that molasses was at least fairly effective in aiding urea utilization, an experiment was started to determine whether growing calves could meet their protein requirements largely from urea with molasses as the source of carbohydrate.

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Three 200-pound heifer Holstein calves were placed on the following ration in which 60 to 65 per cent of the total nitrogen was supplied by urea:

	lbs.
Timothy hay	49
Cane molasses	60-70
Bone meal	2
Urea	2½
Iodized salt	1
Shark-liver oil capsules	

After nineteen weeks, .3 pound of casein per day was added to the ration of each calf, and this ration was fed for a period of seven weeks. At this point, .3 pound of starch was substituted for the casein, and the calves remained on this ration for four weeks. During a final 80-week period, the calves were fed the following ration, which contained less molasses and more starch than the ration previously used:

	lbs.
Timothy hay	42¼
Starch	32¾
Corn molasses	20
Bone meal	2
Urea	2½
Iodized salt	1

Some Slowly Hydrolyzable Carbohydrate Needed For Best Results

Rates of daily gain of the three calves on the various rations follows:

Ration	Daily Gains in Weight		
	No. 1	No. 2	No. 3
	lbs.	lbs.	lbs.
Timothy hay + cane molasses + urea + bone meal + iodized salt + vitamin A	0.77	0.78	0.62
Timothy hay + cane molasses + urea + 0.3 pound casein + bone meal + iodized salt + vitamin A	1.7	1.5	1.6
Timothy hay + cane molasses + urea + 0.3 pound starch + bone meal + iodized salt + vitamin A	1.3	1.4	1.5
Timothy hay + corn molasses + urea + starch + bone meal + iodized salt + vitamin A	1.4	1.5	2.0

Normal gains were not obtained with a ration of timothy hay supplemented with molasses and urea. The addition of casein to this ration resulted in more rapid gains. The substitution of starch for the casein in the third period

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resulted in much better gains than were obtained on the molasses ration alone, although they were not quite equal to the gains obtained on the molasses-casein ration. During the final 8-week period, when the calves were on a ration containing more starch and less molasses, normal gains were made.

Attention was called to the possibility that in an open system such as prevails in the ruminant's tract, some of the molasses sugar may have moved out of the rumen faster than was the case with starch. Thus, the addition of some starch had allowed more efficient protein manufacture to proceed, probably due to the continuous hydrolysis of the starch and a more continuous source of soluble sugar.

Summary of Results

In summarizing results of this work, the authors state: "For maximum growth of calves, a ration made of a roughage, molasses, and urea must be supplemented with some additional source of a more insoluble but fermentable carbohydrate or insoluble protein which can be drawn from the cereal grains or concentrates, such as the oil meals. In our limited experience, this supplemental material need not be more than 3-5 per cent of the total ration."

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TREATING IRISH SEED POTATOES WITH FORMALDEHYDE

Many Irish seed potatoes now being set aside for spring planting are infected with fungous diseases that cut down stand, injure the roots, cripple the potatoes, and reduce yields. Organisms that cause common black scurf or rhizoctonia and under certain conditions common scale and black leg, usually can be controlled by treating afflicted seed with formaldehyde, according to a recent Du Pont Company leaflet.

It says that while seed potatoes are usually treated just before planting, "the work may be done with equal success at any time in the winter or spring, provided the potatoes are dried properly or are not reinfected by storing in old containers or bins which have not been disinfected. It is in fact an advantage to treat some time in advance of planting so that if the sprouts are injured, new ones may form."

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DU PONT PUBLICATIONS DISCUSS SWEET POTATO DISEASE CONTROL

A booklet entitled "Seed Treatment--Its Origin and Application," published by the Du Pont Semesan Company, says that seed sweet potatoes often carry on their surfaces the organisms that cause stem rot, black rot, and scurf.

"These diseases materially reduce yields of marketable roots," it says. "Stem rot and scurf are transmitted from the seed to the sprouts and also from the soil of the seed bed to the sprouts and then from the sprouts to the roots. Disinfecting the seed potatoes before bedding is recommended. In some states disinfecting the sprouts just before planting is thought helpful."

Another Du Pont Semesan leaflet, devoted exclusively to potato diseases, discusses the dip treatment with "Semesan Bel" fungicide to control these sweet potato diseases, and also seed-borne scab, Rhizoctonia, and seed-piece decay of Irish potatoes. It says: "Just stir one pound of 'Semesan Bel' in 7½ gallons of water, which makes enough dip to treat 60 to 80 bushels. Then dip, drain, and dry the potatoes."

A third leaflet, published by the Du Pont Electrochemicals Department says:

"The spread of storage rots can be controlled by disinfecting storerooms, bins, baskets, barrels, and implements with Du Pont formaldehyde (1 pound or 1 pint in 30 gallons of water), or by fumigating by the formaldehyde-potassium permanganate method, using 3 pints of formaldehyde and 23 ounces of potassium permanganate for each 1,000 cubic feet of space."

The leaflet says "the framework of the hotbed and ground around the hotbed should be thoroughly soaked with a solution of one pint of Du Pont formaldehyde in 30 gallons of water."

NOTE: Copies of leaflets mentioned above will be sent on request to Editor, Du Pont "Agricultural News Letter," Wilmington 98, Delaware.

CHEMICALS PLAY IMPORTANT PART IN SWEET POTATO DISEASE CONTROL

"The sweet potato is commercially the second most important vegetable crop in the United States, and is exceeded in volume of production only by the Irish potato."--Dr. O. H. Elmer, Kansas Agricultural Experiment Station.

The devastating effects of disease and decay-producing fungi, the most important factors in limiting profitable production of sweet potatoes on any farm, can be reduced greatly by proper use of chemicals, such as fungicidal treatment of seed and soil and sterilization of structures used for storage.

So says Dr. O. H. Elmer, Botanist and Plant Pathologist, Kansas State College, Manhattan, in Kansas Experiment Station Bulletin 278.

"These fungi are disseminated with affected sweet potatoes and are carried to hotbed and field soils through seed and planting stock," he points out. "Injury from them can be largely prevented by combining effective disease-control measures with the other farm practices incident to growing and storing this crop."

Among the serious fungous diseases that attack sweet potatoes are stem rot and black rot, which are carried on the root and live in the soil. Stem rot produces dark internal discoloration of the stems which may be seen by splitting the stems of the sprouts or of the plant in the field. The infection extends into the sweet potatoes produced by infected plants, but is usually not easily recognizable there. Black rot destroys the sprouts in the plant bed and infects the roots in the field and in storage. Infected plants show black lesions on the stems; infected roots have dark, black, circular, slightly sunken areas. Scurf, known also as soil-stain or rust, is caused by a fungus living on seed of sweet potatoes and in plant beds. It attacks the sprouts, and later infects the crop in the field. It causes a shrinking and cracking of the skin, which results in heavy losses by shrivelling in storage.

Steps recommended by Dr. Elmer for control of sweet potato diseases include treating the roots to be planted with a fungicide just before they are bedded, to kill surface-borne spores or disease-producing organisms that may cause infection in the hotbed or the field. Such treatment does not kill disease-producing organisms within the tissues of infected potatoes.

"Roots with disease lesions must be sorted out before the seed is treated," he says.

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The Kansas scientist also urges that sand or soil used during previous seasons, or soil from fields where sweet potatoes were formerly grown, should not be used in hotbeds as it may contain disease-producing organisms.

"Previously used hotbed frames should be cleaned and then sterilized by wetting them thoroughly with a solution either of copper sulfate (blue vitriol) at the concentration of approximately 1 pound to 10 gallons of water, or of formaldehyde at the rate of 1 pint to 15 gallons of water," Dr. Elmer says. "The solution may be sprayed onto the frames, it may be applied with a broom, or any other convenient method may be used whereby the frames are thoroughly wetted with the fungicidal solution."

Discussing sterilization of storage houses, Dr. Elmer explains that disease and decay-producing organisms remain alive for many months in the sweet potato storage house in soil and refuse from previously stored roots.

"These organisms should be eliminated before the new crop is stored, by removing all soil and refuse and then sterilizing all surfaces, including bins, crates, and baskets," he says.

He also recommends that after the house is cleaned thoroughly, "it should be sterilized in order that the remaining fungous spores may be killed."

"This may be accomplished through the application of appropriate fungicides, either as a spray or as a gas. Effective sterilization is exceedingly difficult or impossible to attain when the soil and litter have not been removed, because such materials protect the spores from the effect of the fungicide.

"Effective sterilization requires that the fungicide be applied to all surfaces in the storage room. When applied as a spray, sterilization results only on surfaces actually moistened by the spray mixture."

Formaldehyde Kills Fungous Spores in Storage House

Dr. Elmer says: "Formaldehyde is one of the most commonly used fungicides for sterilizing the sweet potato storage house. It is very effective in killing fungous spores, and its cost is not high. This substance diluted in water at a concentration of 1 pint in 15 gallons of water can be used as a spray; or formaldehyde can, by appropriate means, be generated as a gas. The formaldehyde solution in water can be safely used as a dip for sterilizing previously cleaned crates or baskets. This solution applied with a broom may also be used for scrubbing, and thus sterilizing walls and floor.

"The most practical method for disinfecting the sweet potato storage house is through fumigation with formaldehyde gas by the formaldehyde-potassium permanganate method. Formaldehyde vaporizes very rapidly when the solution is brought in contact with potassium permanganate, and an exceedingly strong dosage of formaldehyde gas may thus be produced.

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"Effective sterilization through the chemical action of formaldehyde can occur only in the presence of moisture. The surfaces within the house must be moistened, and the house should then be closed for several hours before the fumigation is made. Baskets, boxes, crates, or other equipment used for harvesting and storing the crop may be left in the storage house during fumigation. Such equipment should first be cleaned, and all surfaces moistened just previous to fumigation.

"The dosage that is required for fumigating by the formaldehyde-potassium permanganate method is obtained by using 3 pints of formaldehyde and 23 ounces of potassium permanganate for each 1,000 cubic feet of space. A room 20 by 10 by 10 feet, for example, contains 2,000 cubic feet, and requires 6 pints of formaldehyde and 46 ounces of potassium permanganate.

"The formaldehyde gas may be generated in galvanized or enameled pails of 3 or 4 gallon capacity. Earthenware crocks may be used if such pails are not available, but glass containers should not be used because the heat produced during the reaction may break them. A pail should be provided for every 2,000 cubic feet of space, and they should be distributed in different parts of the house.

"Not more than 46 ounces of potassium permanganate is placed in any one pail. For every 23-ounce portion of the potassium permanganate, 3 pints of formaldehyde are measured into a jar, and the jars are then placed alongside the pails. When everything is in readiness, the formaldehyde is poured onto the potassium permanganate in each of the pails. The operator should begin with the pail farthest from the door, and, working rapidly, should quickly complete the job, get out of the door, and close it as soon as possible. The poisonous fumes are given off as soon as the formaldehyde comes in contact with the potassium permanganate. This chemical action generates considerable heat and causes boiling, which in turn speeds up the reaction.

"It is necessary that the storage house be kept tightly closed during the fumigation period so as to confine the gas. Formaldehyde gas fumigation is not recommended for sweet potato storage rooms in the basement of dwellings unless the house can be vacated during the period of fumigation.

"After the generation of the gas the house should be kept closed for at least 12 hours, and preferably for 24 hours. At the end of this time, doors, windows, and ventilators should be opened from the outside, and the fumes should be allowed to escape before the house is entered."

Copper Sulfate (Blue Vitriol) May Be Applied in Storage House As Spray

"Copper sulfate, also known as blue vitriol, may be applied as a spray for sterilizing the sweet potato storage house or hotbed frames," Dr. Elmer says. "The copper sulfate crystals are dissolved in water at the rate of 1 pound to 20 gallons of water. This chemical is corrosive to metals and the crystals should be dissolved in wooden containers or in earthenware crocks. This solution may be sprayed onto all surfaces within the storage house and it may be used for sterilizing baskets and crates."

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MINIATURE "ELECTRIC FENCE" KEEPS INSECTS IN BOUNDS

Entomologists in the Du Pont Pest Control Research Laboratory at Wilmington, Del., do not want the insects they use in their experiments to fly or crawl away. They need large numbers of these minute "guinea pigs" to determine the insecticidal value of thousands of chemical compounds under constant study.

Flying insects must be kept in cages, but many of the crawling varieties are given the freedom of open, panlike boxes containing growing plants on which the bugs feed. The upper rims of the four sides of the boxes are covered with two narrow, metal strips -- the kind usually used on linoleum. Small wires, carrying a low voltage of electricity, are attached to the two bands of metal, making of them a barrier similar in effect to the "electric fence" on the farm. When wandering insects crawl up the inner side of the box, they come into contact with the electrified strips which shock them just enough to discourage further attempts to cross the barrier.

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WINDOWS CUT IN HEN HOUSES NOW MAY MEAN MORE EGGS NEXT SUMMER

When hen houses are hot both night and day, hens are not able properly to assimilate calcium for making egg shells, and they naturally stop laying, says Dr. O. B. Kent in Du Pont's bi-monthly publication "Poultry Comment." The article expresses amazement at the small number of hen houses that have three-way ventilation. It points out that structures with windows in front only are hot by day, and do not cool off at night in summer. The article adds:

"It is easy to cut openings on the north side, to open the windows just as soon as warm weather comes in the spring, and to leave them open until cold weather comes in the fall. Anyone who has attempted to cull out the hens that have been semi-roasted out of laying appreciates the condition of these houses. It really is a wonder that the birds lay at all."

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DR. ELMER K. BOLTON, DU PONT CHEMICAL DIRECTOR, TO RECEIVE PERKIN MEDAL

The American Section of the Society of Chemical Industry has announced the election of Dr. Elmer K. Bolton, chemical director of the Du Pont Company, to receive the Perkin Medal in recognition of his outstanding accomplishments in the field of industrial research. Dr. Bolton is in charge of the research activities of the Chemical Department of the Company, which in normal times devotes its attention to pioneering applied and fundamental research. He also acts in an advisory capacity on research matters for all departments.

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PAINTING DON'TS

Don't - paint over a wet surface or during wet weather.
- paint over a surface that is not perfectly clean and free from dust and dirt.
- pile a number of paint coats, one on top of the other. In time the coats will be so heavy that they will break down of their own weight.
- apply paint heavily. Brush out well.
- fail to stir the paint thoroughly before application.
- apply succeeding coats without allowing sufficient time for thorough drying between coats.
- fail to paint surfaces often enough to prevent decay and deterioration. It is false economy to attempt to save money by postponing painting when painting should be done.
- fail to read label directions, and follow them carefully, particularly with regard to adding thinners.
- buy cheap paint and expect satisfactory results.

MODERN METHODS FOR PAINTING BARNS AND OTHER FARM BUILDINGS

Painting methods and treatment of barns and other farm buildings have undergone a considerable change during recent years. At one time about the only thing to do with such structures was to paint them red or to whitewash them. Cheap red oxide barn paints were quite generally used. They had short life, often faded badly, and gave very little real protection to the property. Whitewashing had to be renewed yearly to keep up appearances, entailing a great deal of labor with a minimum of property conservation.

Painting Provides Best Kind of "Property Insurance"

The up-to-date American farm home is or can be made a thing of beauty in the surrounding countryside. When grouped compactly around the farm house, the buildings should be treated as one unit, so far as painting is concerned. There is no reason why the same color scheme adopted for the farm home should not be continued, with minor modifications, on the other farm buildings. The application of a reliable brand of paint--white or other light tint--for the body of all farm buildings, with contrasting trim, is good "property insurance." Its use at proper intervals retards decay and deterioration, preserves the attractive appearance of the entire unit of farm buildings, and is a splendid investment in general community welfare.

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How a Start Can Be Made

Below is suggested a practical approach to the paint problem. Each building should be examined separately beginning, for example, with the barn:

Surface	Construction Material	Present Condition	Repairs Necessary	Present Color	Proposed Color	Size (Sq.Ft.)
Roof	Shingle	Poor	(Reshingle (or patch (where (necessary	Unpainted	Green	10,000
Siding	Clapboard	Good	Nail back loose boards	White	White	15,000
Window Sash	Wood	Good	Reputty after first coat.	Green	Green	1,000
Foundation (usually unpainted)	Stone	-	-	-	-	-
Window Frames	Wood	Good	-	White	White	Included in siding
Other surfaces to be painted	?	?	?	?	?	?

Amount Paint Needed For 2 Coats at 300 Sq. Ft. Per Gal. For 2 Coats Application	Shingle Stain For Roof 200 Sq. Ft. Per Gal. One Coat	Products to Use*
For Siding and Frames 50 gals.	50 gals.	Roof - Du Pont Shingle Stain Dark Green Siding - Du Pont Prepared Paint, White Sash - Du Pont Trim & Trellis Dark Green (if available) otherwise Du Pont Prepared Paint Dark Green Frames - same as siding
For Sash 3½ gals.		

*Note - Due to shortages of critical raw materials, it may not always be possible to obtain all the Du Pont products referred to above. Your Du Pont Paint Service Store or Du Pont dealer can supply you with recommended products to use instead, so that you need not defer painting that should be done at this time.

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If, for example, the barn is now red--badly faded and left unpainted for a number of years--it may be necessary to apply 3 coats of white or light tint to obtain proper hiding. Buildings not painted at all should be given 3 coats, following label directions. Where it is desired to continue the red color the same careful survey should be made, repairs completed, and a good quality finish such as Du Pont Barn Paint Red be employed. Two coats are required under normal conditions. "Tufcote" Barn Paint Red is also available in semi-paste form, to which the user adds 1 gallon of raw linseed oil to each gallon of "Tufcote," thus obtaining 2 gallons of paint in mixed form ready to apply as a first coat. The finish coat requires one-half gallon of oil. Two coats give good service at moderate cost.

Maintenance of Roofs of Farm Buildings

It is very important that roofs of farm buildings be maintained in good condition. Small leaks left to grow may result in considerable damage to stored crops and implements. Frequent painting of shingle roofs with shingle stain will prolong their life for many years. There are, moreover, certain types of asphalt roof coatings made especially for use on roll roofing.

Galvanized metal roofs should be allowed to "weather" for several months before painting. Galvanized metal primers which would adhere to such surfaces without pre-treatment were available before the war, but these finishes are "out" for the duration. For prompt painting of such surfaces, an acid wash, using a proprietary brand made especially for the purpose, is recommended followed by a rinse of clear water. When dry, apply a Du Pont Metal Primer, with finishing coats of antioxide paints, shades selected. Light shades of paint on the roof will reflect more heat than dark colors, hence will keep the interior cooler in the summer.

Only Best Paint Should be Used on Siding Surface

The best ready-mixed paint possible to obtain should be used on siding surfaces. It is good economy to pay a little more per gallon for good paint that will spread painting periods four or more years apart, and which will leave the surface in good condition for repainting. The false economy of using low-priced paint cannot be over-emphasized. Often, it fails quickly, necessitating painting every two or three years, and leaves the surface in poor condition for repainting.

Here again, white or light colors are desirable for best appearance as well as for the benefit obtained by reflecting heat and keeping the interior cooler in summer. It is good practice to apply a band about 5 feet high around the bottom of the siding of barns, using a darker color, especially if this surface is subject to animal contact. One coat applied as needed to keep the surface in good condition is recommended for this band of color.

Where the surface has been painted red and where it is desired to continue this color, then Du Pont Barn Paint or "Tufcote" Barn Paint Red is satisfactory.

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Surface Preparation

Surface preparation is the first step in good painting. No matter how good a paint may be or how well suited to its purpose, it cannot accomplish the desired results unless it is applied on a properly prepared surface.

1. All Surfaces: Be sure surface is clean, dry and free from dust, grease and dirt. Sand glossy surfaces to dull the gloss and to improve adhesion. Remove dirt by brushing, or scraping if necessary. Eliminate dust by thoroughly brushing with a painter's duster. Clean off grease by washing with turpentine or a strong alkaline solution followed by rinsing thoroughly with clear warm water. Be sure to allow sufficient time for thorough drying where washed.

Outside painting may be done at any time of year provided the surface is thoroughly dry and the temperature no lower than 40°F.

2. New Wood: Sap streaks and knots should be coated with shellac, substitute shellac, or aluminum paint, if obtainable, and allowed to dry before the first coat of paint is applied.

3. Metal: Clean metal generally presents an ideal surface for painting. Be sure, however, that rust spots, if any, have been scraped down to firm, hard metal, and that grease has been washed off with turpentine before applying the first coat. New metal surfaces should remain unpainted until the scale has rusted off and then wire brush or scrape before painting.

4. All Previously Finished Surfaces: For practical painting, a previously finished surface in good condition is treated in the same way as a new surface that has received its first coat. Thus, where three coats are recommended on a new surface, two coats are recommended to refinish a previously finished surface. Frequently, one coat is sufficient over a previously finished surface. All surfaces must be clean, dry and free from dust and grease. Sand glossy surfaces to dull the gloss and to improve adhesion.

5. Previously Finished Wood: Cracked, crazed and peeling finishes which cannot be removed by scraping or wire brushing must be burned off and the surface painted as if it were new wood. Hard, glossy surfaces should be roughened with sandpaper so that new paint will adhere. Spots where old paint has worn down to the bare wood, should be touched up. If an oil paint is to be applied, remove old whitewash by scraping, brushing or washing and allow the wood to dry thoroughly. Putty all surface imperfections after the first coat is dry. Be sure the surface is firm, dry and clean.

6. Previously Finished Metal: Remove rust and mill scale by scraping, wire brushing or sandblasting. Remove all loose and scaling paint. Touch up bare metal spots in accordance with priming instructions for new metal. Sand glossy surfaces to dull gloss and to improve adhesion. Be sure the surface is firm, clean and dry.

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7. Mildew and Fungous Growths: Remove mildew by washing with a solution of one pound of trisodium phosphate or one pound of sodium bicarbonate dissolved in a gallon of warm water, or with a 3% solution of Lysol. Rinse with clear, warm water and allow surface to dry.

Product Preparation

To enable any paint to give satisfaction, it is necessary to stir thoroughly so that pigment and oil are mixed as completely as when they left the factory.

Ready-Mixed Paints: Open the container. Pour any oil that may be on top into a clean, empty container. Stir the paint in the original container bringing up any pigment that may have settled at the bottom. It may be necessary to pour half the paint into a second empty container to facilitate stirring each half. Then pour the oil back, carefully stirring the oil into the paint, and finally pour from container to container to make sure all pigment and liquid are mixed thoroughly. Stir frequently during application.

"Tufcote" Barn Paint: Open the container. Place half of the paste in a clean, empty container. Pour some of the thinning oil - quantities specified in label directions - into the paste, stirring continuously. Continue adding parts of the thinning oils while stirring until all liquids have been added. Pour the paint from container to container to make sure that all paste and liquid are mixed thoroughly. Stir frequently during application.

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BEWARE GIFT WRAPPINGS FROM OVERSEAS!

Not long ago, cotton packed in and around a captured German helmet, sent as a gift from a service man to a friend in this country, was found by foreign plant quarantine inspectors to contain pink bollworms living in the seeds, says Marion J. Drown, Agricultural Research Administration, in the "Extension Service Review," for November, 1944. He adds:

"The pink bollworm is the most destructive of all cotton pests. Fortunately, owing to a continued fight against it, it has not so far become established in our cotton-producing States, except in one or two limited areas. Bollworms can live as long as two years in cottonseed.

"And cotton is not the only packing material that is suspect. Straw and grass may carry other dangerous insects or plant diseases. So if you receive any souvenirs from service men, don't take chances. Burn the wrappings and packing material so that no fifth-columnist or Trojan-horse enemies shall be let loose in this country to menace cotton and other crops."

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CHEMICAL AIDS LAWN MOWER -- ELIMINATES TEDIOUS HAND WORK

"Ammate" weed killer, used in a narrow band close to well-established trees, grape vines, and shrubs, as well as posts, fences, sidewalks, and foundations of buildings, "keeps down weed and grass growth, enables the lawn mower to cut all of the grass, and eliminates much tedious hand work," says E. P. Sylwester of the Iowa Agricultural Extension Service. He recommends spraying a 6-inch strip at the first cutting of grass in the spring. He points out that the material exerts only temporary sterility, is not flammable, does not stain foundations or sidewalks, and is not poisonous to livestock or humans.

Mr. Sylwester emphasizes the need to keep "Ammate," the active ingredient of which is ammonium sulfamate, off the foliage and bark of valuable trees and plants. He also warns that it should not be used around newly planted trees or around such plants as peony, iris, chrysanthemum, bleeding heart, and other similar herbaceous perennials because they will be killed if their roots absorb the chemical.

HORMONE SPRAYS SAID TO HAVE REDUCED McINTOSH APPLE DROP DURING HURRICANE

"Parmone" pre-harvest fruit-drop inhibitor, containing naphthalene acetic acid as the active ingredient, was used both in spray and dust form by many apple and pear growers throughout the country in 1944.

While no claims are made for its ability to keep fruit from dropping during such high winds as occurred during the September hurricane, the following, published in the magazine "Horticulture," October 1, 1944, is of unusual interest:

"Early reports from the hurricane-lashed orchards of New England indicate that use of hormone sprays to prevent early drop of apples was effective in saving a large part of the McIntosh crop.

"In orchards where such a material had been carefully applied about Labor Day, only 10 per cent of the crop went on the ground during the fateful night of September 14.

"In other cases, where, perhaps, the spraying was less well-timed and the winds may have been higher, dropping ranged up to 25 to 30 per cent of the crop. McIntosh trees, in the same areas, which were not sprayed with the hormone material lost up to 80 per cent of their crop."

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EXPERIMENT STATION-INDUSTRY RELATIONSHIPS*

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Relationships between the experiment stations and industry in the development of pest control products, as well as other agricultural products, deserve serious thought in order that the present trend toward closer cooperation may be continued and improved, This is an age of cooperative thought and action. While the individualist may still find a place in science, the shut in methods and professional jealousies of the past are being replaced by organized, cooperative effort. This wholesome spirit of teamwork has in recent years contributed to more rapid progress. Certainly we have not yet reached the saturation point in productive research effort in any field of science and probably will not reach it for a long time, if ever. This is especially true in the sciences of entomology and plant pathology which are relatively new and which concern biological problems where evolutionary changes are constant. In fact, these sciences are still exhibiting some of the symptoms of growing pains. Organized research in them has been developed within the past few decades, and the establishment of experiment station-industry relationships is even more recent. The earlier organized research was directed toward the exploratory phases of the causes of the troubles and the effects of the parasite on the host and on the development of suitable techniques needed in conducting research in these new sciences. Not a great deal of time was given to developing control measures. Often too much reliance was placed in a few established formulations which were to be prepared by the user with ingredients obtained from the local drug store and applied as best he could. The cure was sometimes worse than the disease. However, the fundamental work that was being done probably deserved first place in the research program, for it laid the foundations necessary to the progress that has followed, and which is continuing to expand.

After this background of knowledge of insects and diseases was developed an increasing interest was shown in the economic losses caused and in more effective means of control of the more important pests. Prominent among the control measures considered were better chemical formulations and the development of suitable means of applying them to obtain best results. There was a resulting increase in the demand for active chemicals, better supplements to use with them and equipment for use in their application. Attention was given to

*Address delivered at Annual New York State Insecticide and Fungicide Conference, Ithaca, New York, November 28, 1944. Published at the request of the Program Committee of the Conference, Prof. L. M. Massey, Head, Department of Plant Pathology, Cornell University, Chairman.

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specific needs and chemical formulae were adjusted for most efficent use. This trend was also seen in the fields of livestock insects and diseases, and in household insect control. The general need for fungicides and insecticides in the forest and lumber industries and other industrial fields was more slowly recognized, but we have seen much progress in this direction in recent years.

With the research progress in developments of insecticides and fungicides by the experiment stations and other public institutions, the demands on industry for chemicals, applicators, and other supplies increased to the point where industry was attracted by the volume possibilities. Promotional efforts were undertaken and as often proved true in many new developments where there were no regulatory laws, transients, or fly-by-nights took their toll. Unfortunately, even the reliable concerns were not sufficiently informed to present the facts and properly advise and service their products. The unsound advice disseminated as a result of the lack of knowledge on the part of established organizations, and both to lack of information and good ethics on the part of the transient tended to produce friction between industry and research institutions, especially the experiment stations who felt a keen responsibility for the welfare of the farmer and other users of products recommended as a result of their research. Often the products actually sold to the user bore little or no relations to the product recommended by the experiment station or research organization and it was not uncommon for information obtained from the station to be misused. As a result of this feeling of mistrust on the part of teachers and research directors in the colleges and experiment stations, trained research men in the agricultural sciences were advised to keep out of industry. This situation undoubtedly was responsible to some extent for the lack of consideration of the industrial phases of the development of agricultural products in the training of men in the agricultural sciences at a time when it was much needed. As special situations developed in industry where technical advice was much needed an occasional entomologist or possibly a pathologist was attracted by an unusual salary and probably discharged as soon as the special job was finished. Then there was the fly-by-night with a professional title assigned for promotional purposes. Such actions tended to further aggravate the situation.

Fortunately, during the past 25 years there has been a gradual and increasingly rapid improvement in experiment station-industry relationships. A mutual understanding of each other's problems has been developing. The importance of pest control, as well as other agricultural problems, and the necessity for supplying satisfactory products with the much needed services in connection with their use has served to impress these organizations with their common interests in, and their obligations to serve agriculture in the most effective manner. Along with these changes have come State and Federal regulatory laws which have to a large extent eliminated unethical concerns and helped place industrial activities in this field on a much sounder basis. Industry and agriculture have profited by this. The tasks of the experiment station and of ethical industry have become more pleasant.

As the work progressed, the entomologists and pathologists were able to increase their efforts toward the development of control measures in cooperation

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with other agricultural sciences concerned with crop and livestock improvement, as well as with related and contributory sciences including those in industry. Attention is given to cooperation with industry in the development of suitable machinery for applying insecticides and fungicides. There is a trend toward regional and national cooperation between experiment stations which is helpful to both agriculture and industry. It tends toward the more general recognition and use of valuable products and enables the producer to make more general recommendations.

Industry is turning more and more to research as a means of securing its future progress, and the agricultural field offers promising possibilities. The discoveries of today are the commodities of tomorrow, and there is always room for further progress. No sound industry is satisfied with anything but the best materials and service it can offer today and is constantly striving to improve its products and to find new and better ones for tomorrow. Such progress is assured only through organized and efficiently managed research. Some of the chemical companies who have been successful in research in other fields have within recent years organized biological units in the field of pest control research. This research is directed specifically to the development of better chemical controls for pests of various kinds, and especially insects and fungi. There has recently been a marked increase in the number of chemical companies entering this field of research. There are other industrial companies, some of them with less extensive interests in agricultural developments, who arrange for their biological research with public or endowed institutions through fellowships or grants of other kinds. Some of the companies with their own research units may establish such grants for the solution of special problems. This entrance of the chemical industry into the field of agricultural research is logical. With the literally thousands of new chemicals being synthesized in their laboratories for many other possible uses and with an excellent array of chemical talent to serve wherever there is a need, all promising fields for the effective use of chemicals are being considered. This accounts for their entrance into the agricultural field. The extensive and valuable work of the experiment stations and other research institutions can be credited to a large extent for laying the foundations for industry. The purpose of the research unit in industry is to supplement the work of the experiment stations and facilitate progress in the development of pest control products. These biological organizations are in position to work closely with the industrial chemists and help screen out from the numerous chemicals available those which have value as insecticides, fungicides and for other agricultural uses. Chemical synthesis of effective products may result from the intimate contacts and knowledge of the needs obtained by the chemists who are associated with the biologists in these laboratories. Some of these industrial organizations are equipped to extend the investigational work to determine the merit of their chemicals in practical application. However, their research work can be considered only as a supplement to the extensive work done by the State and Federal experiment stations before recommendations can be made for use of a product under the many climatic, varietal and other variable conditions existing in agriculture. If this method of cooperation is followed, industry not only supplies the few effective chemicals to the experiment stations for trial, but as a rule these products are

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formulated for specific uses so that the station men can test them with the least possible trouble. Chemical organizations are equipped to find and incorporate suitable conditioning agents into the necessary formulations for the uses indicated. Some of the experiment stations are prepared for such work while others are not. This method offers a means of facilitating the evaluation of large numbers of chemicals in the shortest possible time and saves the experiment station the trouble and expense of testing ineffective products and doing the preliminary work of testing and formulating the products that have value. Besides, there is the possibility that many of the products probably would not be tested at all without this special interest on the part of industry. It is not intended to imply or suggest that the described method is being, or should be followed generally as a plan of cooperation between the experiment stations and industry. It represents a type of procedure that has in some cases been followed with apparent success. Other arrangements have no doubt worked equally well. The essential thing is for all transactions to be handled in a way that is agreeable to the cooperating agencies. Grants or fellowships and other cooperative arrangements involving finances of course function differently. The products involved may be supplied by industry to the institution receiving the grant which in turn supplies the supervision, facilities, and men for conducting the test work. The function of the industrial agency in the actual conduct of the work is determined by agreement. The disposition of records through publication or otherwise also as a rule is determined and specified in the agreement. It would be useless to try to draw up a general plan that would function satisfactorily. The circumstances in each case determine to a large extent the best course to follow. However, those arrangements which enable the research men of the agencies concerned to confer at regular intervals appear to have definite advantages. Such arrangements promote thorough understanding and facilitate progress.

Regardless of the type of cooperative arrangement, the experiment station and the industrial organization represented have rights that must be safeguarded. The experiment station is a public institution. The results of its research belong to the people. The station officials are obligated to protect those rights. Likewise, industry has special interests in the products of its inventions. In planning and conducting cooperative research effectively it is often desirable for both organizations to have full information concerning the nature and composition of the products and of the developments throughout the investigation. It is important that no misuse or careless release through publication or otherwise be made by either party of pertinent information obtained through such arrangements. The experiment station officials and the representatives of industry, in most instances, recognize these rights and there appears to be an increasing willingness on the part of all parties concerned to cooperate in maintaining them.

The time required to solve many problems where biological factors are concerned is well known to the experiment stations. The lack of a thorough understanding of this time factor on the part of industry has in the past led to disappointments and possibly some misunderstandings that have affected experiment station relationships. Industry is learning to appreciate the many complications involved and in many cases is no longer laboring under any illusions

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of a quick and successful outcome. There is no excuse for undue caution or pessimism and delay. On the other hand, over optimism often proves expensive. These facts are too well known to the experiment station men to need further comment.

Through cooperative research arrangements and through its research activities, industry is obtaining the much needed knowledge and appreciation of the needs and complications of the pest control field. They are learning more and more about the requirements of their own manufactured products and how to improve and service them. There is a better understanding of the problems confronting the experiment station men, and the need for employing trained men by industry who understand these problems, and who see the experiment station viewpoint, for development and sales work. These trained development men supplement the work of the station extension services by helping to demonstrate the efficient use of their companies' products, and otherwise serve and advise concerning them.

Undoubtedly, the active interests of industry in research in the pest control field has been responsible for some of the improved relationships between the experiment stations and industry. The missing links between discovery, applied research, production and finally the efficient use of agricultural products are being supplied through cooperation. It is through such cooperation and coordination of effort that the many problems confronting agriculture and industry can be viewed in their various aspects and trained minds representing the various sciences and professions involved, employed in their solution.

The development of insecticides and fungicides for use on the farm represents only a part of the cooperative research of the experiment stations with industry in pest control research. The control of household and storage insects and the prevention of fungus molds and decay of many items in the household and in industry are receiving much attention. The insect and fungus problems of forests, forest products, shade trees and ornamentals present special problems for research. Many of the processors of agricultural products such as fruits and vegetables are establishing research laboratories to study pest control and the many other problems concerned with the progress of their business. They require the services of trained agricultural specialists including entomologists and pathologists. Such research organizations cooperate with the experiment stations, and with other industries including the chemical industry and farm machine manufacturers. The designers and manufacturers of spraying and dusting machinery and other mechanical equipment for applying pest control products, including specially equipped airplanes, auto gyros and aerosol bombs for instance, require a thorough knowledge of the various needs and special requirements which they are able to obtain through the use of trained men and through cooperation with experiment stations and other research institutions. This of course does not take into consideration the cooperation between these institutions in connection with the development of many other agricultural products such as fertilizers, plant hormones, washing and grading supplies, packaging equipment development and many other items where cooperative research is desirable.

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There has been some concern expressed as to the effect the more extensive entry of industry into the field of research in pest control and other fields will have on the responsibilities in the future of experiment station personnel, especially entomologists and plant pathologists. Are the experiment stations to become testing agencies for industry? The answer, for a number of reasons, should be -- "No." Industry is not equipped to do a complete job of developing and servicing agricultural products, especially insecticides and fungicides. The purpose should be to supplement the excellent work of the experiment stations and other interested research institutions. There is so much yet to be done that no one should be left without important work to do. The more industry does in research on insecticides and fungicides the greater assurance the station entomologists and pathologists have that uniform and effective products will be supplied to the consumer when recommended by them. This in no way discounts the valuable discoveries and developments that have been made by the State and Federal research laboratories. There will undoubtedly be many more such inventions and developments by them in the future.

We are still developing chemicals for pest control, to a great extent, by the cut and try method. A thorough knowledge of the physiology of insects and fungi, and of their hosts, and their host relationships should enable us to develop more workable theories as to the kind of chemicals best suited to the control of these pests, and, at the same time, prove safer to the host plants and animals and to humans who make and apply them or use the treated products. New problems are constantly arising. New species of pests may be introduced or new strains may arise through the continuous evolutionary changes taking place in nature. Study of such fundamental problems and the development of control measures other than the use of chemicals will undoubtedly occupy many station men in the future. However, a cursory review of the problems of chemical control as they may effect the future of station men does not appear discouraging. Leaving aside the discoveries of the stations themselves and considering only a few of the discoveries of industry, there seems to be some room for optimism. Let's consider briefly a few such cases. When we attempt to review the extensive literature of the research work done by the experiment stations on the organic mercurials for the disinfection of seeds, soils, lumber and other items it is obvious that many State and Federal men have been occupied over a period of years helping to solve the many research problems involved in adapting these products to use. Then we have the derivatives of dithiocarbamic acid, including the thiuram sulfides and the dithiocarbamates, as well as other promising organic fungicides which are attracting attention and which offer much promise. The stations are doing the major part of the research required to establish effective usages for these products. In the insecticide field you can easily guess the leading candidate. It probably would be accurate to say that never in the history of entomology has any insecticide been given so much attention in so short a time as has DDT. Of course the urgent needs for better insecticides for war use have been to a great extent responsible for this intensified effort. In spite of the amount of work done, we are only beginning to appreciate the research problems involved in defining and developing the many fields of use for this product in war, in agriculture, in the home, and in industry following the war. The discovery of an effective product is only the beginning of the research involved. For example, we have not yet abandoned such chemicals

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as arsenic, sulfur and copper in our research programs in the field of pest control. We can only surmise the amount of research that is yet to be done on some of these newly discovered products. Many of the problems involved are not simply a matter of routine testing, but are problems requiring fundamental research. There will be many obstacles to overcome that will require the highest type of ingenuity. It is probably reasonable to say that the major part of this work insofar as it pertains to agriculture will be done, at least in the near future, by the experiment stations. The problems of industry will be to keep abreast of these developments with improved processes, which enable them to manufacture high grade materials, and in the case of chemicals to provide products suitably formulated to effectively fill the many needs. With industry expanding its research interests into the agricultural field, it seems only reasonable to assume that the present trend toward a corresponding increase in experiment station responsibilities will continue and that, instead of a curtailment of experiment station research there will be an increasing need for expansion of research effort. Certainly there is plenty of need for greater coordinated research effort all along the line if agriculture is to keep abreast of other sciences. For example, we still measure our losses due to insects and diseases in terms of billions of dollars annually in spite of the control measures in use. Pest control problems become more acute as populations increase and agricultural production becomes more intensified.

Unfortunately, the present emergency has resulted in a shortage of trained agricultural research men. This is especially true in the case of entomologists and to a considerable extent pathologists. Fewer men are being trained. Some of the trained men are in the services where their special training is not being used while others are serving in their capacities as entomologists and pathologists in connection with the important insect and fungus control problems confronting the war efforts. The problems facing the experiment stations and industry alike are more urgent as a result of the war needs. Both are feeling the acute shortage of men. This shortage of men will be alleviated in part when the war is over and the trained men in service return to take positions in the experiment stations and industry. It appears that there will still be a shortage of trained men after the war which will probably continue until our graduate schools in the agricultural colleges and universities can supply the demand. This shortage is especially likely to be felt with the trend in industry toward the employment of technically trained men for development and sales work as well as for research. It will be necessary for these graduate schools to attract and develop larger numbers of men in the years immediately following the war. The recent trend in a few universities and agricultural colleges to emphasize the pest control problems encountered in industry should be continued and broadened both in entomology and plant pathology. Thorough consideration should be given to the requirements of industry in the training of men who prefer industrial work. For instance, emphasis on chemistry, physics, statistics, and mechanical engineering courses will be found helpful in addition to the required biological work needed for research and development work involving extension and practical application. The trained men who go into industry will have the viewpoint of the experiment station and agricultural college and will be in position to help build and maintain better cooperative relationships between industry and these institutions.

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There are other important developments directed toward thorough understanding and closer cooperative relationships between the experiment stations and industry. As a result we are now taking part, experiment station and industry alike, in discussions of the many pest control problems of mutual interest. I have often heard these Annual New York State Insecticide and Fungicide Conferences referred to as an outstanding example of cooperation between experiment station men and the representatives of industry. The regional meetings of entomologists, horticulturists and pathologists are leaning more and more toward round table, frank discussions of insect and disease control problems with industry represented. The summer field tours, organized by Ohio and other states, where results of the products are reviewed and thoroughly discussed, are very helpful. The trend toward joint discussions of the practical problems of pest control concerning experiment stations and industry appears to be increasing at the meetings of the national associations of economic entomologists and plant pathologists. It is hoped that these valuable trends continue to expand and that new methods of improving experiment station-industry relationships will be developed, so that, following the war, the demand for trained men will be filled in the shortest possible time and cooperative research, development and educational work in agriculture will go forward in a more comprehensive way.

NOTE: A reprint of the foregoing address by Dr. Tisdale will be sent on request to the Editor, Du Pont "Agricultural News Letter," Wilmington 98, Del.

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